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DEPARTMENT OF REGISTRATION AND EDUCATION

MINERAL RESOURCES AND  
MINERAL INDUSTRIES OF THE  
EAST ST. LOUIS REGION, ILLINOIS

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MINERAL ECONOMICS BRIEF 12

April 1966

ILLINOIS STATE GEOLOGICAL SURVEY



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MINERAL RESOURCES AND MINERAL INDUSTRIES  
OF THE EAST ST. LOUIS REGION, ILLINOIS

Robert L. Major

A B S T R A C T

The mineral resources, primary mineral producing operations, and mineral processing facilities in the East St. Louis Region are located and described in this report. The region includes Madison, St. Clair, and Monroe Counties in southwestern Illinois. Value of mineral production in 1964 was \$32.3 million, and the minerals produced were, in order of their value, coal, crushed and broken stone, clay products, crude oil, and sand. In addition, the region possesses undeveloped minerals of potential importance such as oil shale, gypsum and anhydrite, feldspar-bearing sands, and pyrite. The industrial complex centered around the towns of East St. Louis, Granite City, and Alton contains numerous mineral, metal, and fuel (oil and gas) processing facilities. These include iron and steel plants, nonferrous smelters, oil refineries, and non-metallic processing plants.

INTRODUCTION

This report is the first in a series of eight concerning Illinois mineral resources and related mineral industries. The series is being prepared by the Mineral Economics Group, with the assistance of staff members in other sections of the Illinois State Geological Survey. Each report will consider one particular region of the state. This report covers the East St. Louis Region, comprising three counties that make up the Illinois portion of Metropolitan St. Louis (fig. 1).

The relative importance of this region as a producer of various mineral commodities for the period 1954 to 1964 is shown in figure 2. Coal showed a rather good growth rate up to 1958 but then declined, while industrial minerals and crude oil have remained steady or declined slightly during the decade. The region is a relatively large producer of mineral products in relation to its size, producing about 12 percent of the state's coal plus a substantial amount of crushed stone and clay products. Table 1

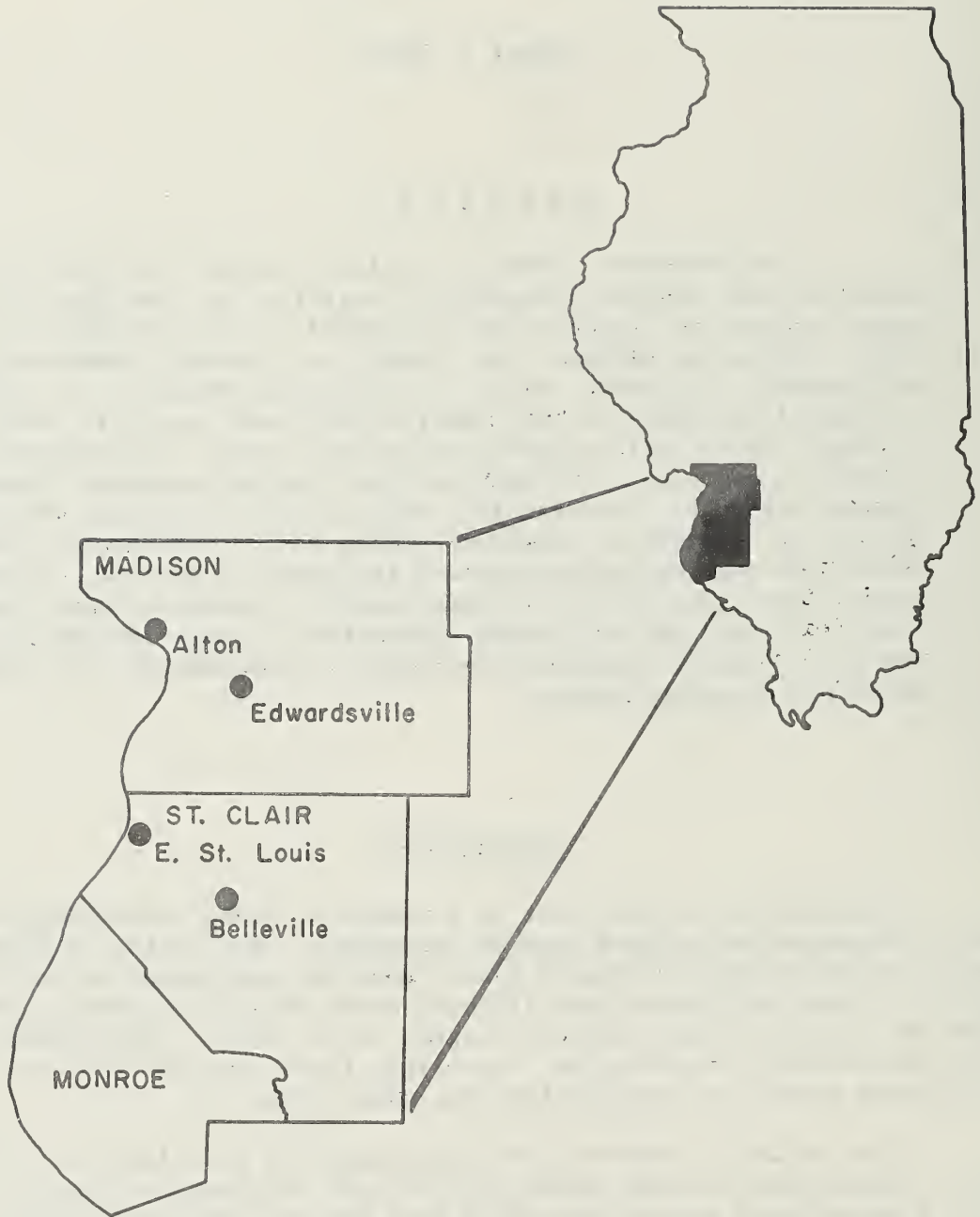


Fig. 1 - Location of the East St. Louis Region.

gives a breakdown of the size of the payroll and the number of employees dependent upon the mineral industries in the East St. Louis Region. These data reveal that the region's mineral industries directly employed 1721 persons and accounted for a payroll of \$10,235,000 in 1958, which is about 5 percent of the state total for the mineral industries for that year.

The mineral production value for the region (table 2) was \$32.8 million in 1963 and \$32.3 million in 1964, or 5.3 and 5.2 percent, respectively, of the state's total for each of the two years. The five main commodities produced, in order of their value in 1964, were coal, crushed stone, clay products, crude oil, and sand.

Each of the commodities will be discussed in terms of resources, past and present production, and the extent of producing facilities. Undeveloped minerals of potential importance will also be considered, as well as the mineral, metal, and oil and gas processing facilities of the East St. Louis area.

### COAL

Illinois is abundantly endowed with coal resources. A detailed assessment and classification of coal reserves in the state was begun in 1950 under the direction of Gilbert H. Cady, then head of the Coal Section of the Illinois Geological Survey. The results were published by the Geological Survey in 1952 as Bulletin 78 (Cady, 1952). Estimates for 20 coals were made and grouped into four categories of reserves—proved, probable, strongly indicated, and weakly indicated—based on reliability of data. All coals that were less than 28 inches thick were excluded. The total estimated reserves of all classes amounted to more than 137 billion tons in the ground, of which 121 billion tons are included in the three most reliable classes.

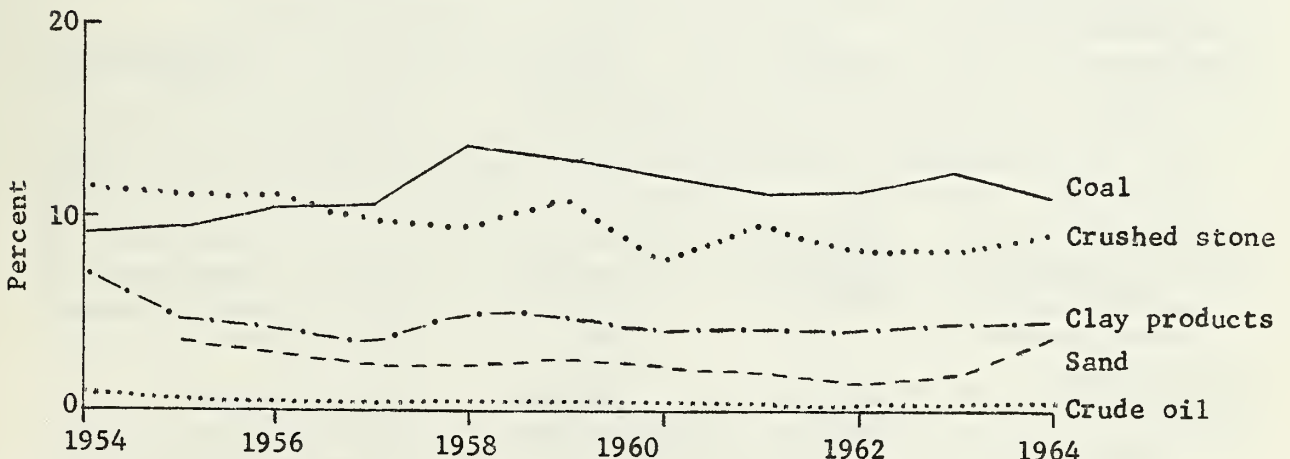


Fig. 2 - East St. Louis Region mineral production as a percentage of the total Illinois production for that commodity.



TABLE 1—EMPLOYMENT AND PAYROLL OF THE MINERAL INDUSTRIES  
IN THE EAST ST. LOUIS REGION\*

County	No. of employees	Payroll (\$1000)
Madison	537	\$ 2,784
Monroe	N.A.†	N.A.†
St. Clair	1,184	7,451
Regional total	1,721	\$ 10,235
State total	27,482	\$144,359
Percentage of state total	4.3	5.2

\* Source: U. S. Census of Mineral Industries, 1958.

† Data are not available in Census of Mineral Industries records. Only one limestone quarry is known to have operated in this county recently.

TABLE 2—MINERAL PRODUCTION IN THE EAST ST. LOUIS REGION\*

Commodity	Quantity	Value	No. of producers	Average value
1963				
Coal (tons)	6,292,018	\$23,909,668	9	\$3.80 per ton
Crude oil (barrels)	279,000	825,840		2.96 per bbl
Limestone (tons) (crushed & broken)	2,900,972	5,131,317	7	1.77 per ton
Clay products		2,443,849	5	
Sand (tons)	492,715	486,630	4	0.99 per ton
Total		\$32,797,304		
1964				
Coal (tons)	5,930,418	\$22,476,284	9	\$3.79 per ton
Crude oil (barrels)	320,000	937,600		2.93 per bbl
Limestone (tons) (crushed & broken)	3,488,691	5,998,572	8	1.72 per ton
Clay products		2,386,976	4	
Sand (tons)	521,000	513,000	3	0.98 per ton
Total		\$32,312,432		

\* Small quantities of natural gas were produced in 1963 in the East St. Louis Region, but data are confidential.

No attempt was made in Bulletin 78 to differentiate strippable reserves from underground reserves despite the recognized need for such differentiation. Therefore, in 1957, a new study was begun to evaluate strippable coal reserves in the state. The state was divided into nine resource regions, and by the end of 1965 five of these had been studied. The results have been published as Illinois State Geological Survey Circulars 228, 260, 311, 348, and 374 (Smith, 1957, 1958, 1961; Smith and Berggren, 1963; Reinertsen, 1964). In these reports the coals were estimated for various depths of overburden (0 to 50 feet, 50 to 100 feet, and 100 to 150 feet) and according to reliability of data (Class I - Primary Reserves; Class II - Secondary Reserves). Coals less than 18 inches thick were excluded.

Total coal reserves for the East St. Louis Region reported in Bulletin 78 were modified by Smith (1958, 1961) by adding the new reserves that had been calculated in the strippable coal reserves studies and subtracting the areas that had been mined out since the earlier report. The revised figure for total minable coal reserves in the East St. Louis Region now stands at 2.6 billion tons, or about 2 percent of the state's reserves. Strippable coal reserves for these three counties amount to 1.9 billion tons, or 10 percent of the state's strippable coal reserves. Over 70 percent of the region's coal reserves are of the strippable type. Figures 3 and 4 show the county-by-county breakdown on strippable and total minable coal reserves.

#### Low-Sulfur Coals

For more than 50 years there has been considerable interest in Illinois coals of low and relatively low sulfur content. Probably the first systematic studies of low-sulfur areas were by Cady (1919, 1922). Hundreds of face channel samples from Illinois mines have been analyzed and their sulfur content reported in the past half century (Cady, 1935, 1948).

A rough check of the records reveals that the majority of analyses of Illinois coals show a range of from 3 to 5 percent sulfur (dry basis), although some show slightly to markedly higher sulfur content. Several large areas of reported relatively low-sulfur coal are present in the state.

A substantial area of low-sulfur Herrin (No. 6) Coal occurs in Madison and St. Clair Counties (fig. 3) near Troy. In this area perhaps up to 70 square miles of coal occurs in which the sulfur content is thought to be less than 1.5 percent. J. A. Simon (personal communication, 1966) estimates the low-sulfur coal reserves (in the ground) at between 350 and 400 million tons. Analyses of coal from one mine that operated in this low-sulfur coal area were reported by Cady (1948, p. 21). Three face channel samples from that mine averaged about 1 percent sulfur. Cady (1935, 1948) also published considerable information on the quality of the coals in this region. The Herrin (No. 6) Coal in this area is high volatile C rank (Simon, personal communication, 1966).

Locations of operating coal mines in the East St. Louis Region in 1964 are shown in figure 5. Production has occurred in all three counties, but only Madison and St. Clair are presently active. St. Clair County was the leading producer of the three both in 1964 and in past cumulative production. For each county, the cumulative production of coal from 1882 to 1964, the total number of active mining years, and the last year of reported production appear in figure 6.

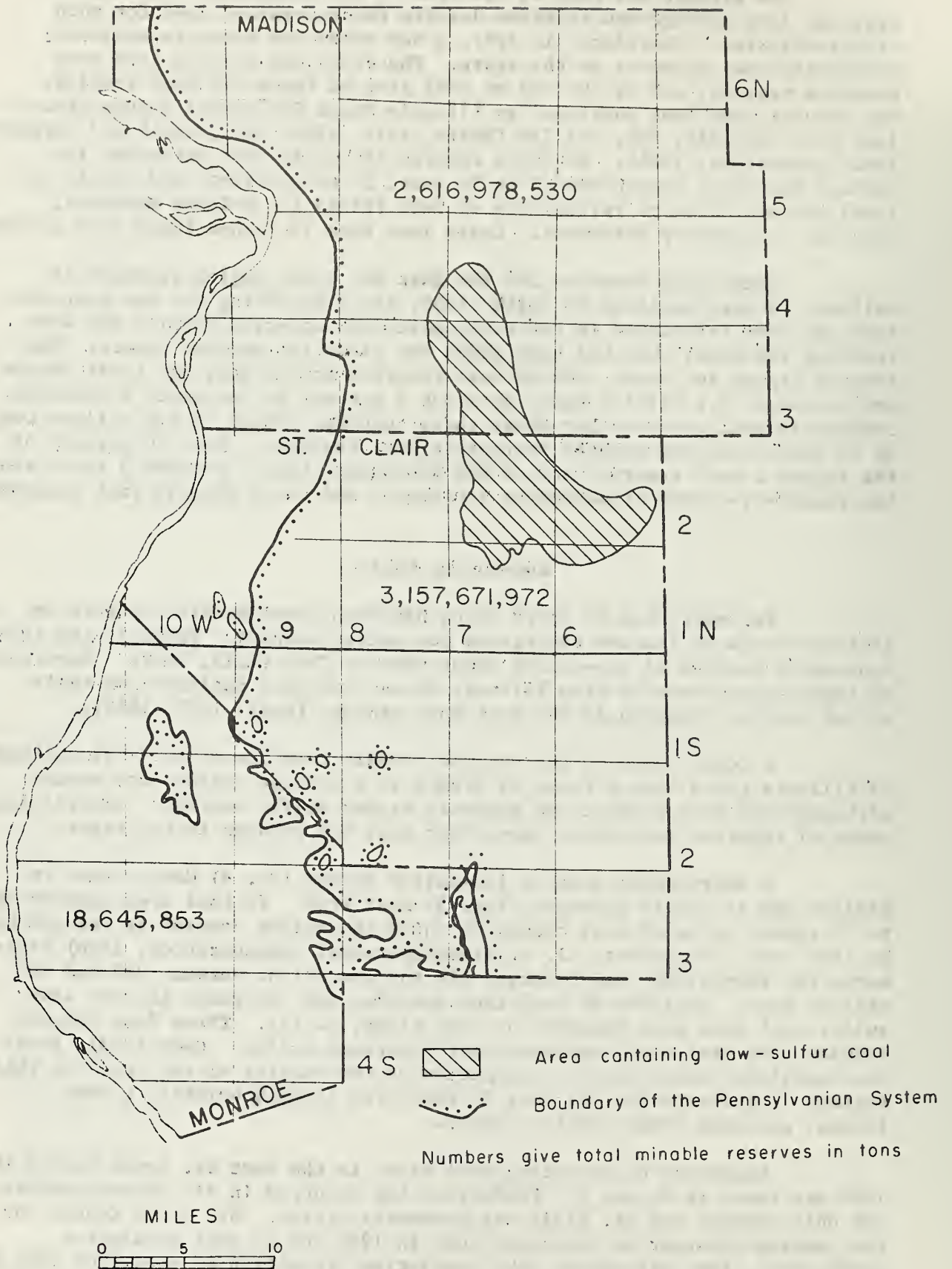


Fig. 3 - Movable coal reserves in the East St. Louis Region. Data for county totals are from Cady et al. (1952) with adjustments resulting from more recent strippable coal studies by Smith (1958, 1961).



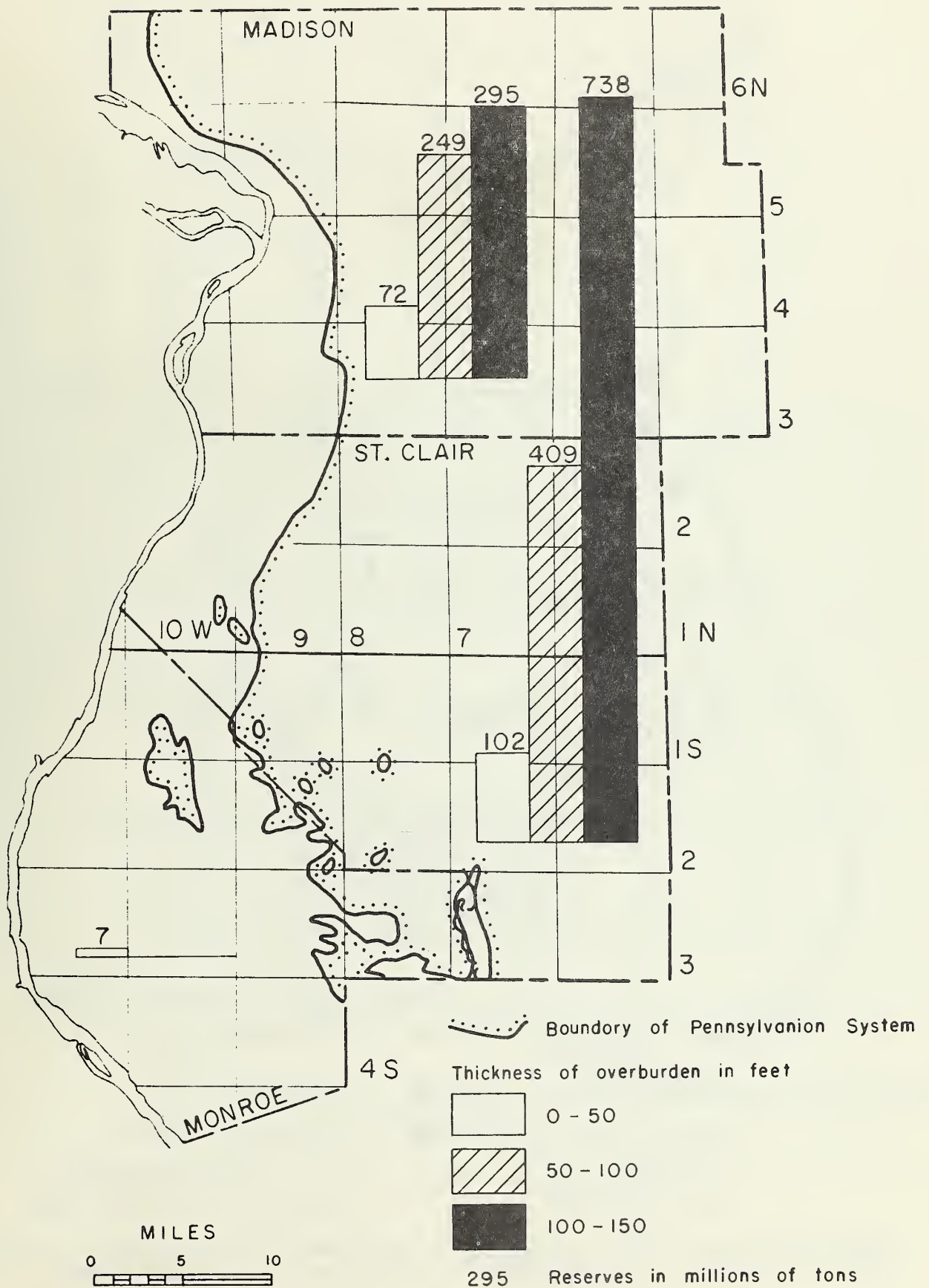


Fig. 4 - Strippable coal reserves in the East St. Louis Region.

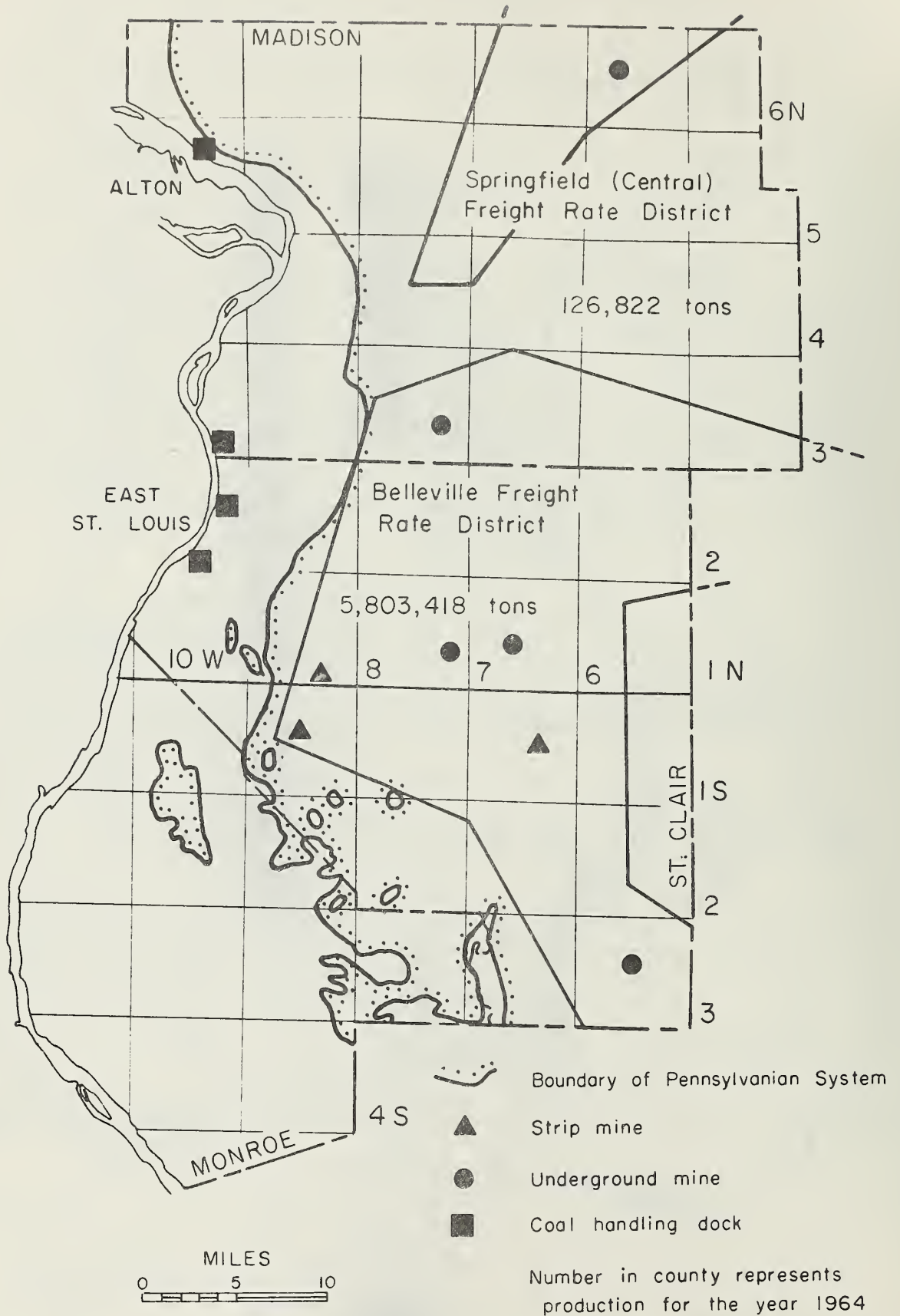


Fig. 5 - Coal mines and production in the East St. Louis Region, 1964.

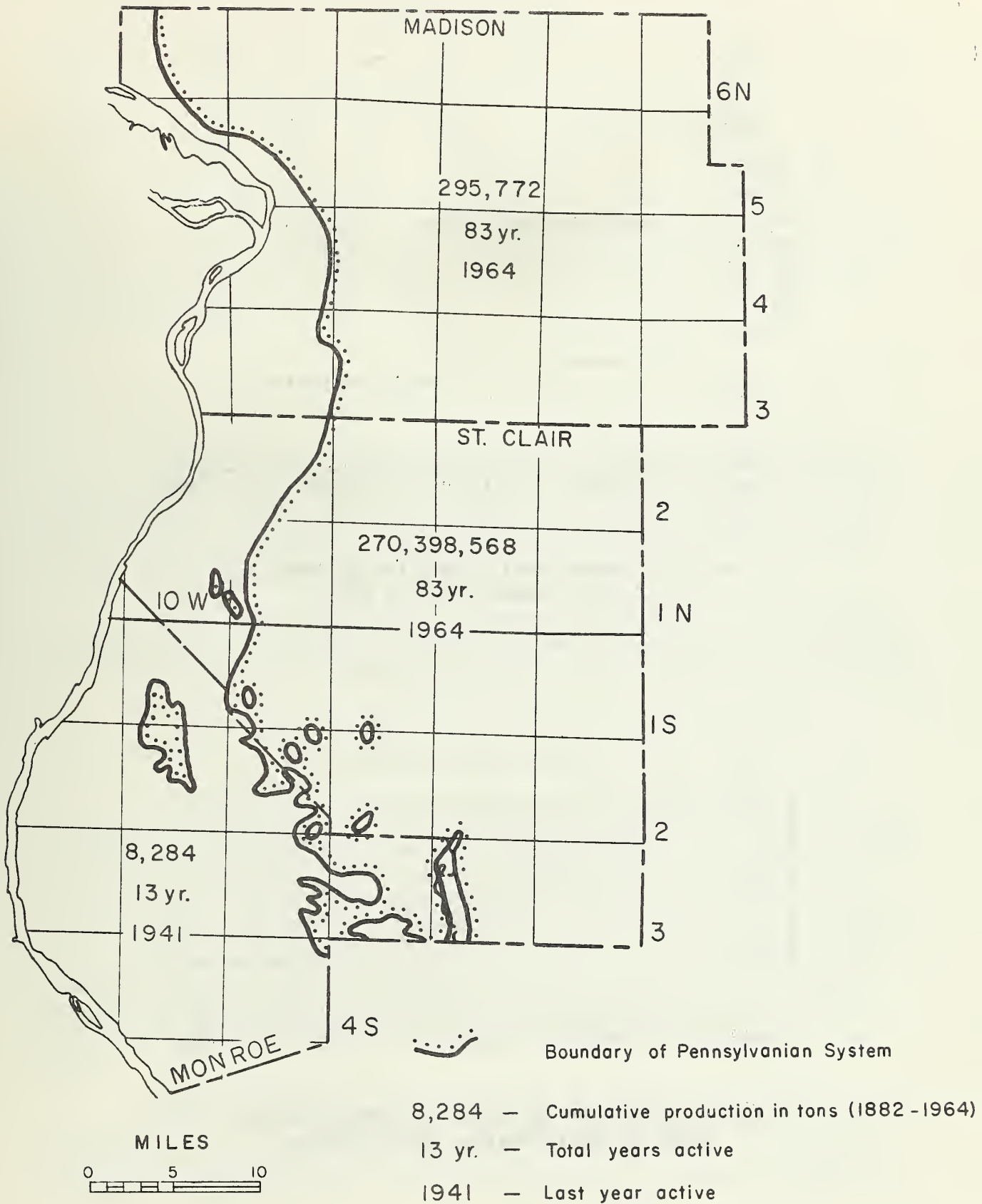


Fig. 6 - Cumulative coal production in the East St. Louis Region, 1882-1964.

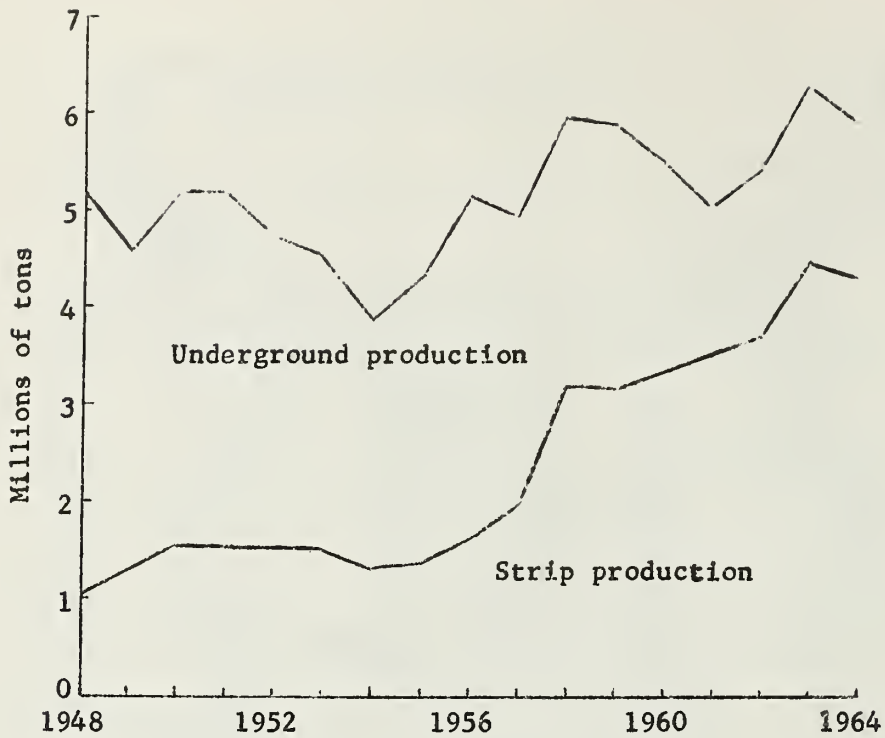


Fig. 7 - Annual coal production in East St. Louis Region, 1948 to 1964.

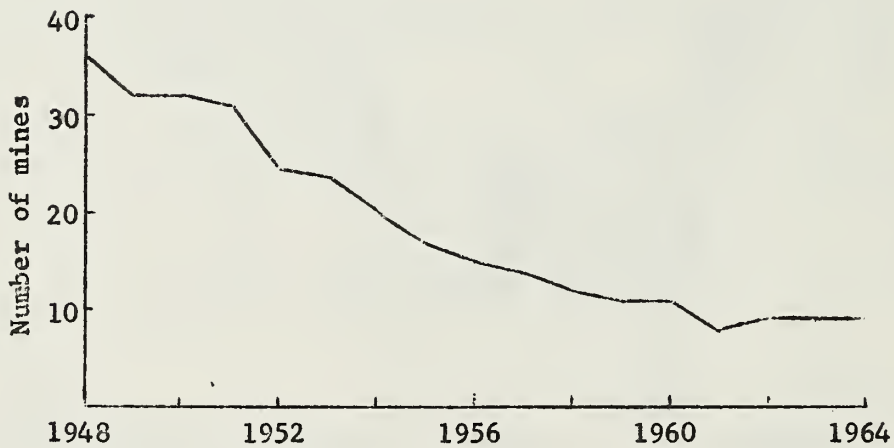


Fig. 8 - Number of operating coal mines in the East St. Louis Region, 1948 to 1964.



TABLE 3—COAL PRICES\*

County	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Madison	3.82	3.86	4.05	4.18	4.33	4.26	4.22	c	4.06	4.20
St. Clair	3.32	3.39	3.62	c	c	3.69	3.59	3.59	c	3.55
State average	3.66	3.84	4.00	4.02	4.06	4.00	3.91	3.86	3.80	3.79

\* Source: U. S. Bureau of Mines. Average value per ton = value received or charged for coal f.o.b. mines as reported to the U. S. Bureau of Mines. Includes a value for coal not sold but used by producers, such as mines fuel and coal coked, as estimated at average prices that might have been received if such coal had been sold commercially.

<sup>c</sup> Confidential data.

Figures 7 and 8 indicate some general trends in the coal industry during the past 17 years. From 1948 to 1964, the number of operating mines declined sharply while the over-all production increased slightly. At the same time, the average size of mines was growing, and the productivity of workmen also was increasing. Strip mining, too, has grown rapidly in the East St. Louis Region.

Table 3 gives the average reported value per ton of coal produced by county and year from 1955 to 1964. The lower values for St. Clair County coal reflect the use of stripping operations with their relatively lower cost.

#### LIMESTONE AND DOLOMITE

In Illinois the principal products of the stone industry are crushed and broken stone for road surfacing, for agricultural limestone, and for aggregate, which is used in concrete and bituminous roads and in concrete structures. The East St. Louis Region contains abundant carbonate rock resources. The limestone produced comes from deposits of Mississippian or Ordovician age. The stone industry operates six quarries and two underground mines. Detailed information concerning the limestone resources of the East St. Louis Region can be found in the reports by Baxter (1960, 1965), which deal with limestone resources in Monroe, Madison, and St. Clair Counties, and Bradbury (1963), which covers the lower Kaskaskia Valley. Figure 9 indicates the distribution of the various limestones and dolomites in the region.

Regional production and value of crushed and broken limestone from 1954 to 1964 are shown in figure 10. In 1964 eight quarries in the three counties reported a combined production of 3.4 million tons, or 9 percent of the state's stone production. St. Clair County was the leading producer of the three.

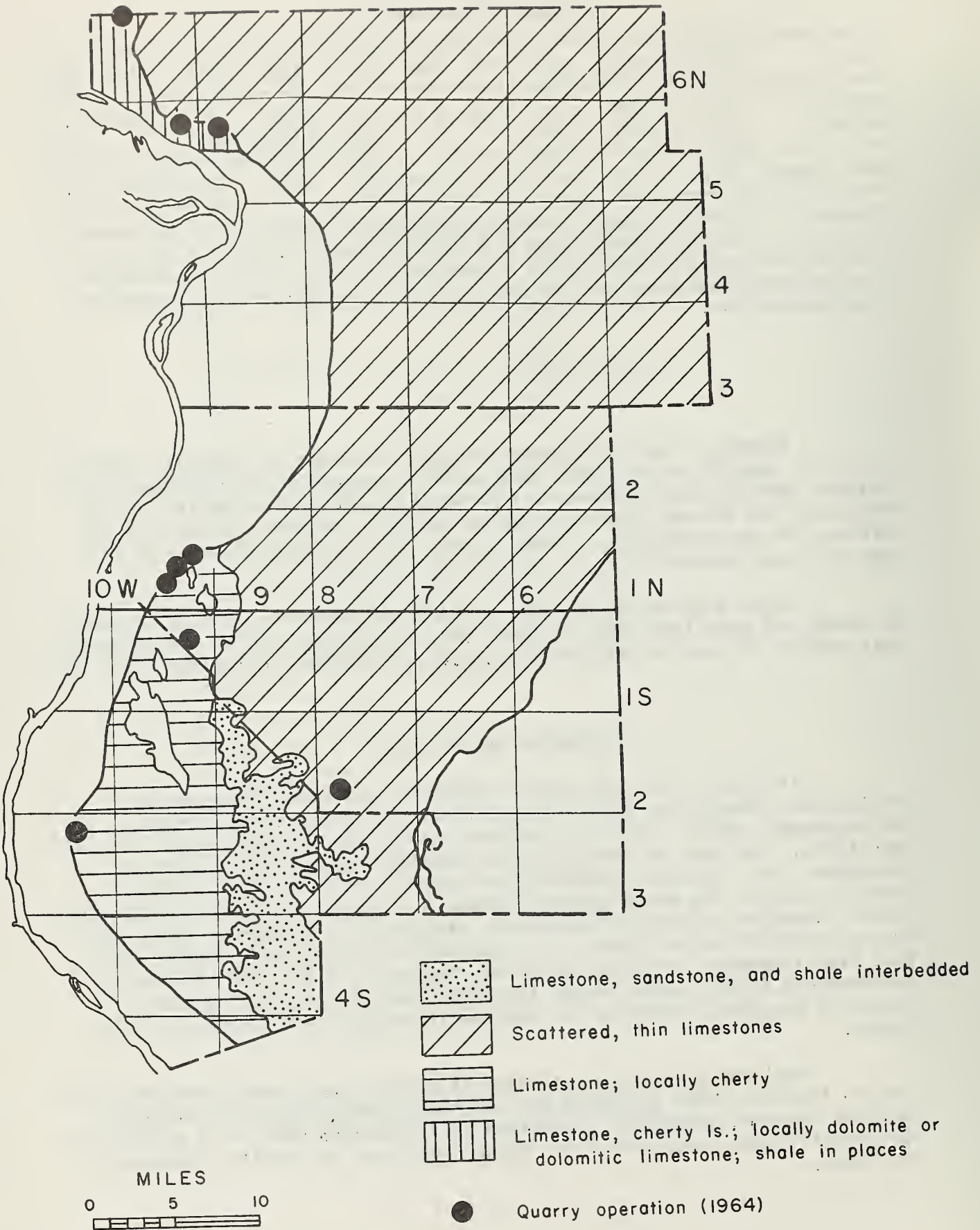


Fig. 9 - Stone resources and operations in the East St. Louis Region.

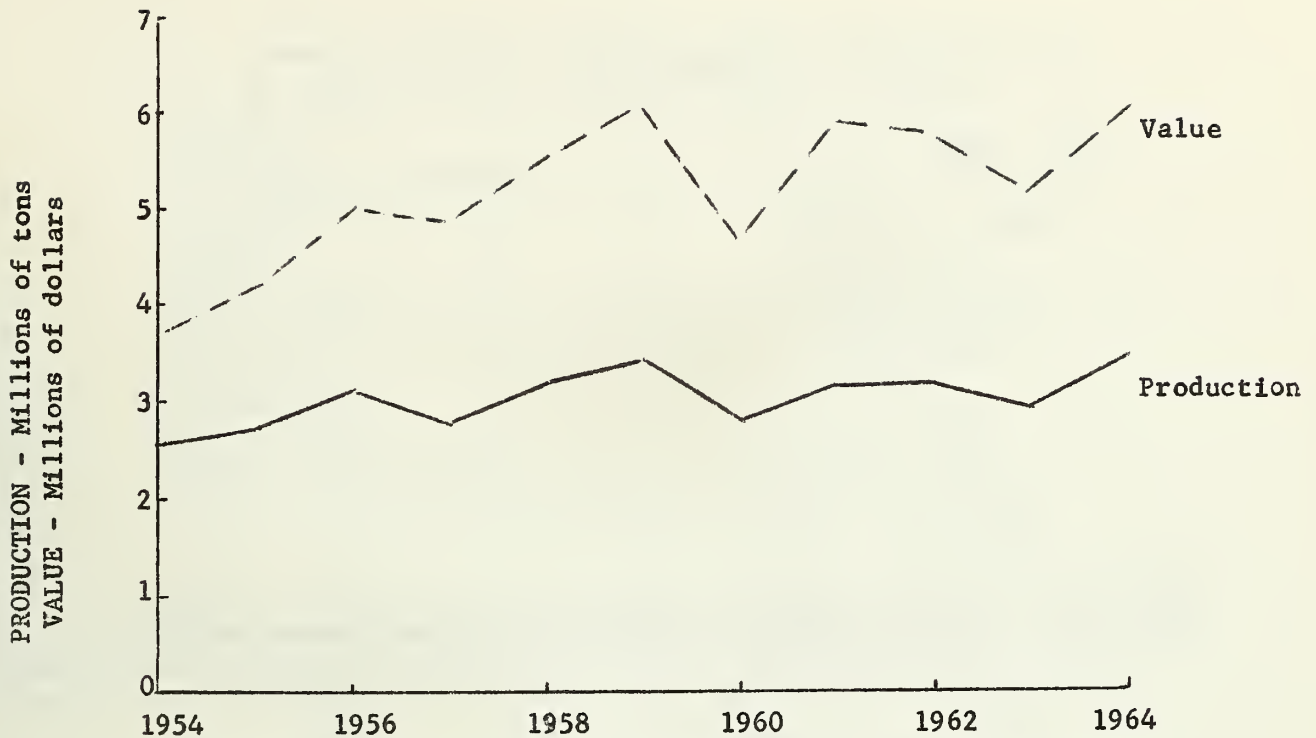


Fig. 10 - Production and value of crushed and broken stone in the East St. Louis Region, 1954-1964.

#### CLAY AND CLAY PRODUCTS

Pennsylvanian clays and shales occur widely in the region. They supply the raw material base for a clay products industry that partially supplies the Greater St. Louis market. A number of clay and shale samples from the area have been collected and tested and results were published by Parmelee and Schroyer (1921), White (1960), White and Lamar (1960), Parham and White (1963), and White and O'Brien (1964, p. 76-80). Figure 11 shows the localities from which the samples were collected.

Figure 12 indicates the approximate limits of the various grades of "strippable" refractory clay deposits. The term "strippable" is used rather loosely to indicate those areas where the ratio of overburden to clay thickness falls within the generally accepted limits of present mining practices and economics. More detailed information on locations, tonnages, and types of clay resources can be obtained from Illinois Geological Survey personnel.

White and Lamar (1960) compiled results of tests for 125 samples of clay run over a period of years. Of these samples, six were taken from localities in the East St. Louis Region. Their suggested uses break down as shown in the following list.



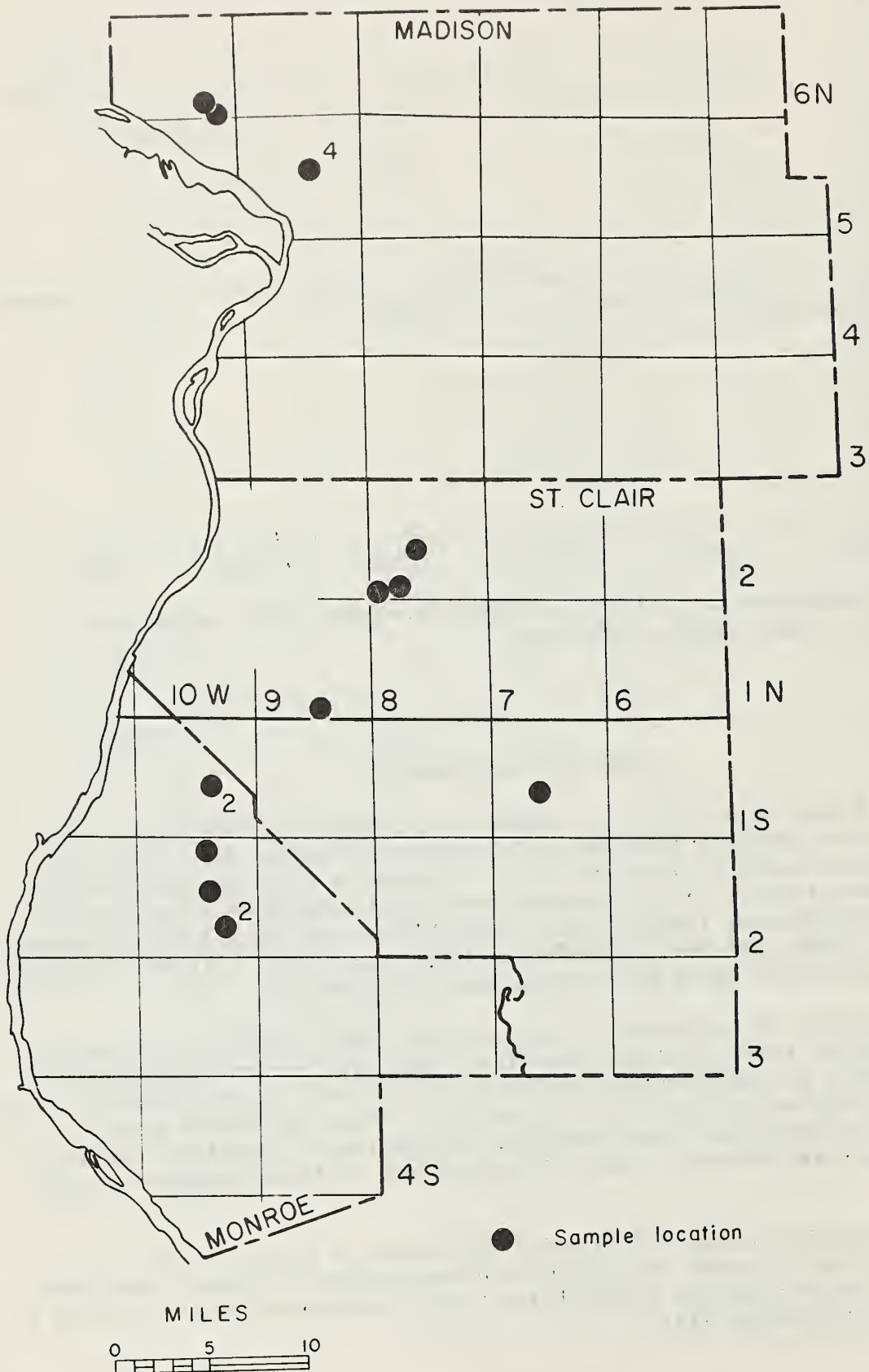


Fig. 11 - Location of clay samples collected from the East St. Louis Region. (Data from Parmelee and Schroyer, 1921, White and Lamar, 1960, and Parham and White, 1963.) Numbers indicate multiple samples.



Use	Number of samples
Drain tile	4
Structural clay products	3
Flower pots	3
Sewerpipe	3
Common brick	1
Hollow brick	1
Face brick	1
Glazed brick	1
Enameled brick	1
Fireproofing	1
Building block and tile	1

Parham and White (1963) listed the results obtained from 66 samples of clay collected in southern and southwestern Illinois. Nine of these were collected from localities in the region under consideration. On the basis of these tests, the clays were found suitable for the following uses.

Use	Number of samples
Pottery	9
Structural clay products	9
Sewerpipe	9
Stoneware	6
Flue liners	6
Flower pots	5
Drain tile	5
Refractories	5
Ponding clay	5
Fillers	4
Terra sigillata	4
Lightweight aggregate	3

New construction methods requiring lighter building materials have increased the market demand for lightweight aggregates. Illinois clay and shale resources suitable for such use were discussed by White (1960) and White and O'Brien (1964). In addition, some lightweight aggregate is produced from blast furnace and smelter slag. Hydraulic Press Brick Company in French Village, St. Clair County, is the only plant presently producing lightweight aggregate in the East St. Louis Region.

Illinois is an important producer of clay products, manufacturing between 50 and 60 million dollars worth annually for the past decade. Despite its favorable location with respect to the St. Louis market, the clay products industry in this region is rather small. In 1964 four companies produced

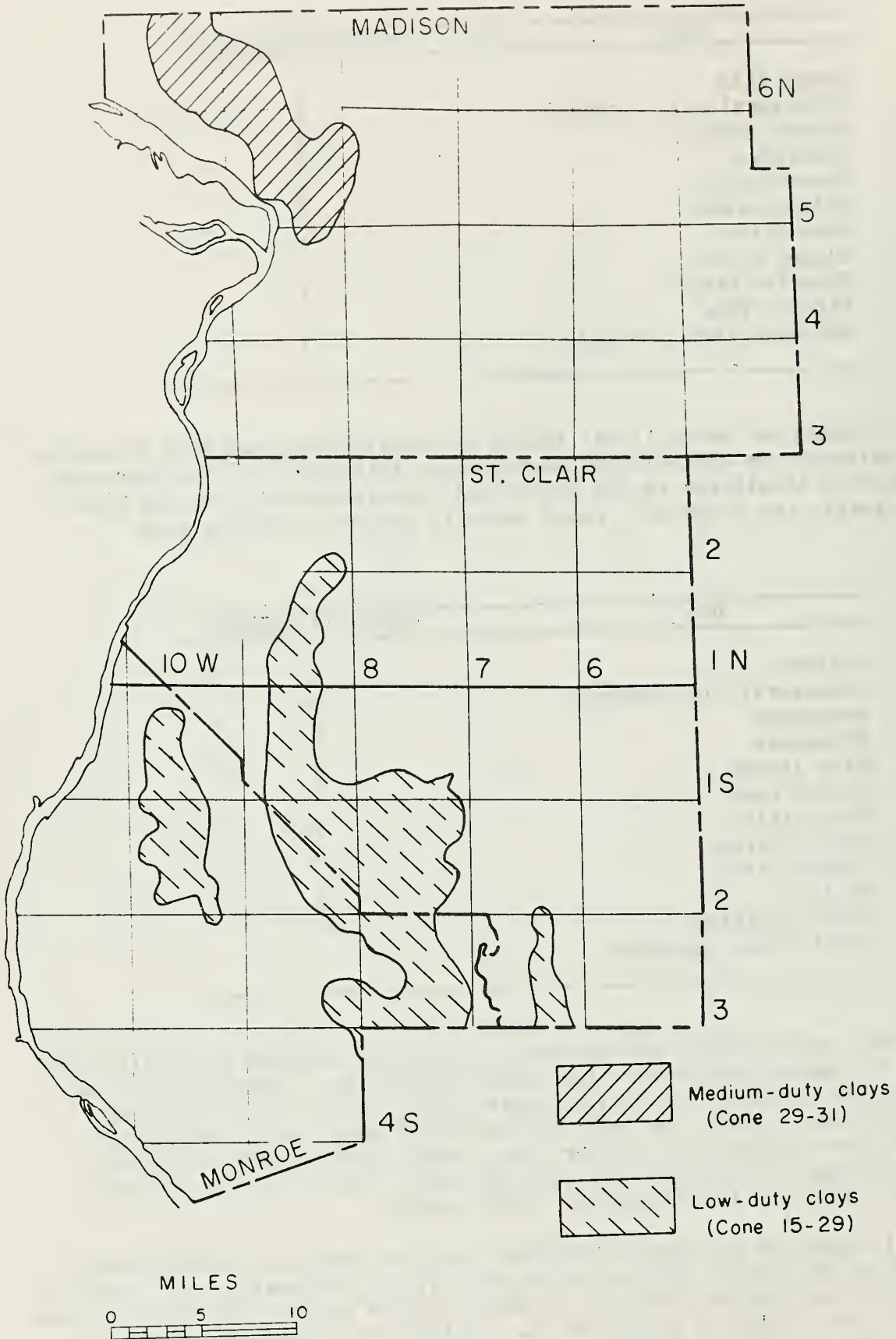


Fig. 12 - Strippable refractory clays in the East St. Louis Region.  
(Data from White and O'Brien, 1964.)

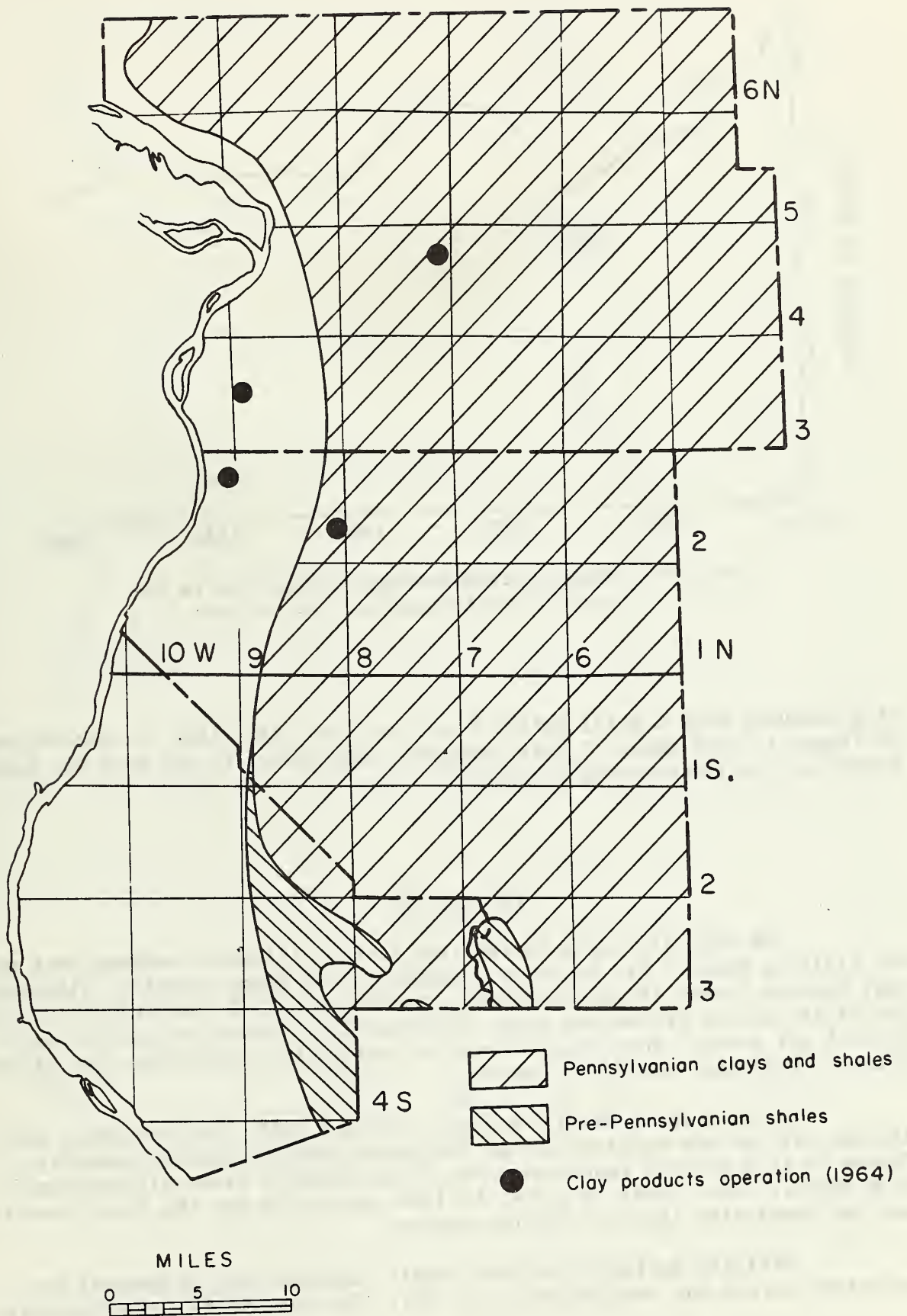


Fig. 13 - Clay resources and operations in the East St. Louis Region.

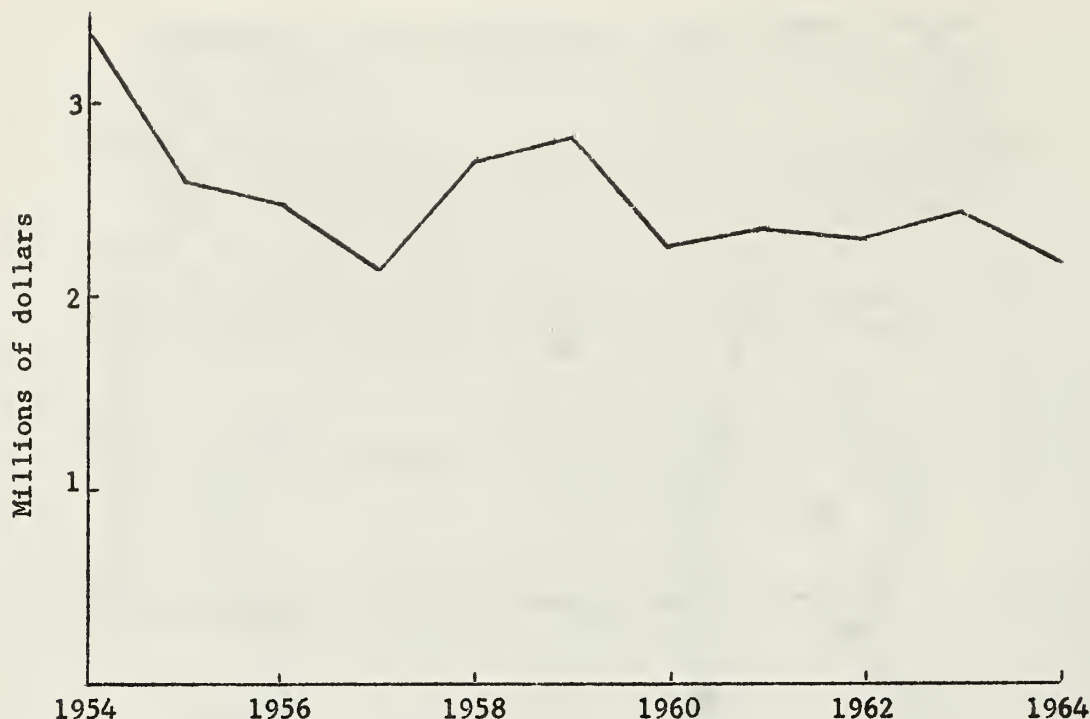


Fig. 14 - Value of clay products production in the East St. Louis Region, 1954 to 1964.

clay products with a total value of \$2.4 million (fig. 13). As can be seen in figure 14, the value of clay products manufactured in the East St. Louis Region has declined during the past 10 years.

#### OIL AND GAS

The East St. Louis Region lies in the shallower, western part of the Illinois Basin. Oil has been produced in all three counties, although only Madison County is now producing. The locations of the various oil and gas fields in the region are shown in figure 15. Production comes from several pay zones. They are, in order of cumulative production, the Silurian, Trenton, Devonian, and Pennsylvanian.

After a sharp decline between 1954 and 1957, the production rate leveled off and has remained around 300,000 to 350,000 barrels annually. Figure 16 is a graphic representation of the region's crude oil production from 1954 to 1964. Table 4 shows the 1964 production for the three counties and the cumulative 1888 to 1964 production.

Drilling activity has been highly variable, but in general has decreased during the past decade (fig. 17). The best years for discoveries



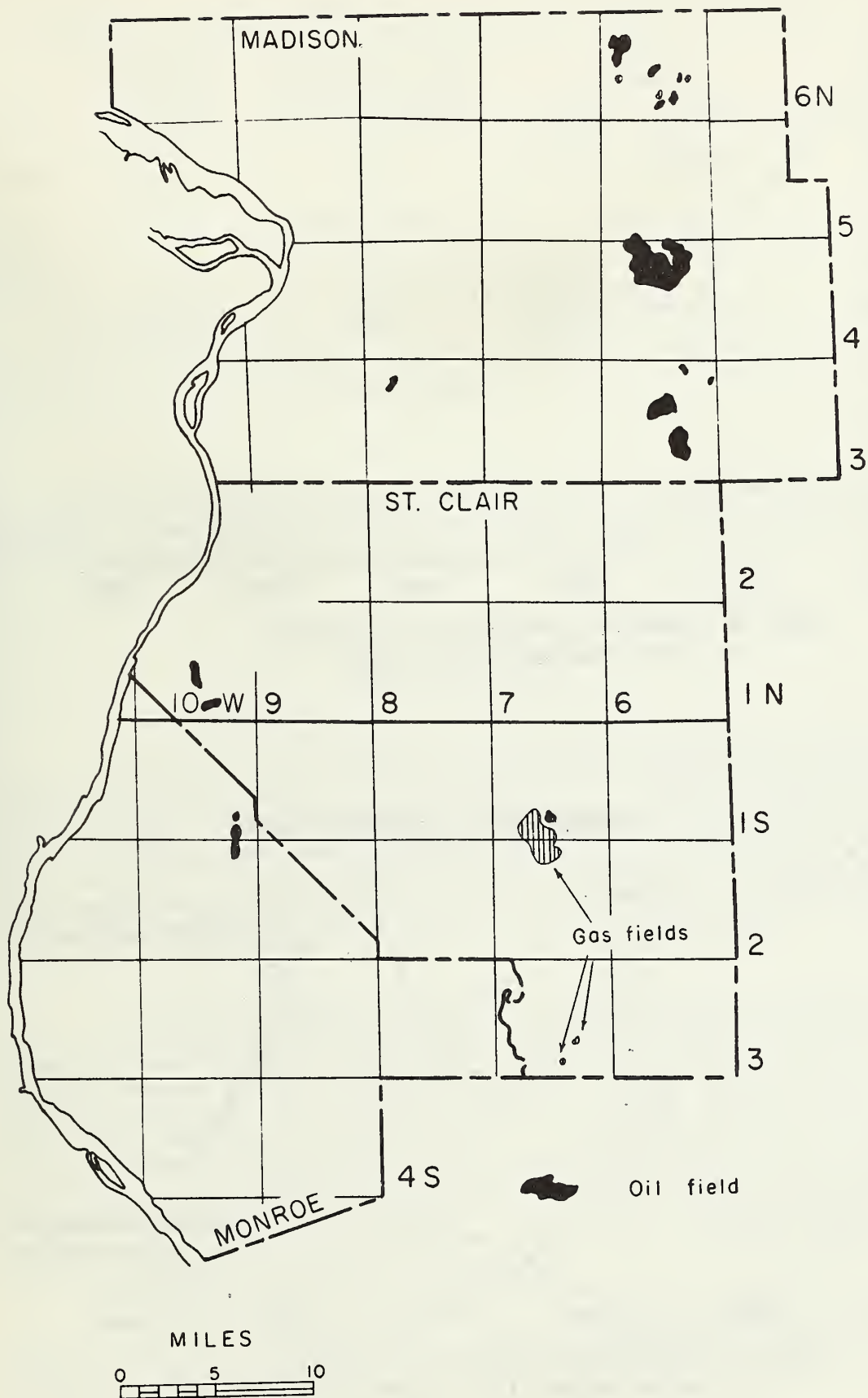


Fig. 15 - Oil and gas fields in the East St. Louis Region.

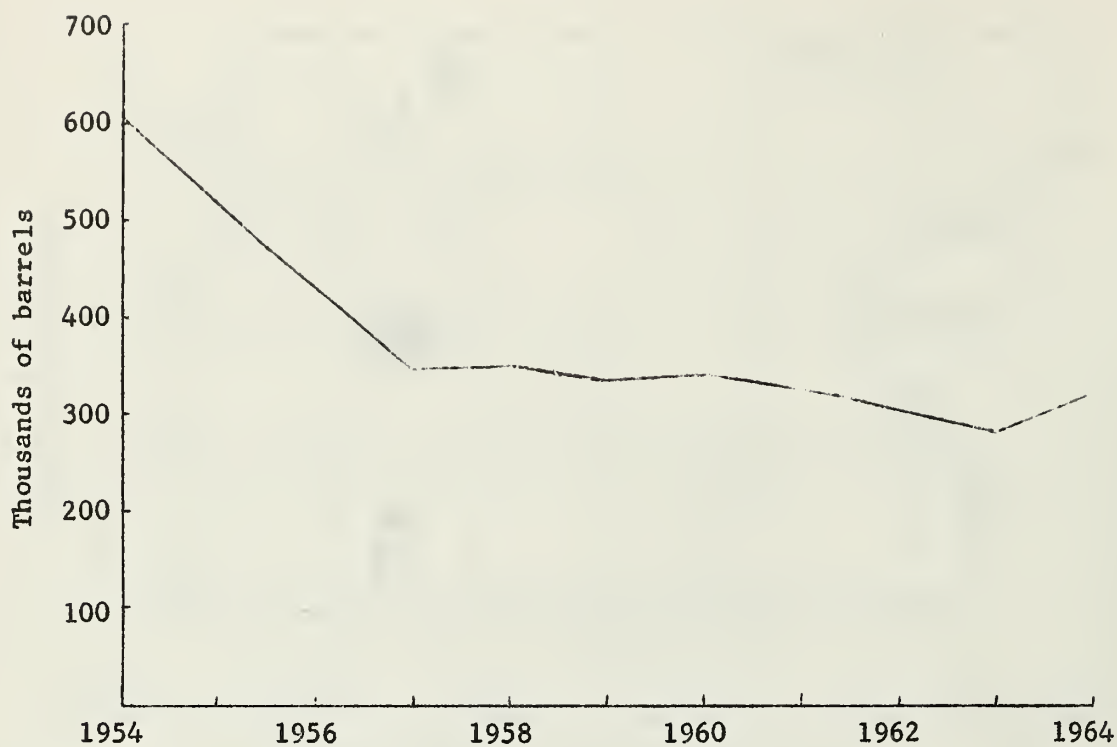


Fig. 16 - Crude oil production in the East St. Louis Region, 1954 to 1964.

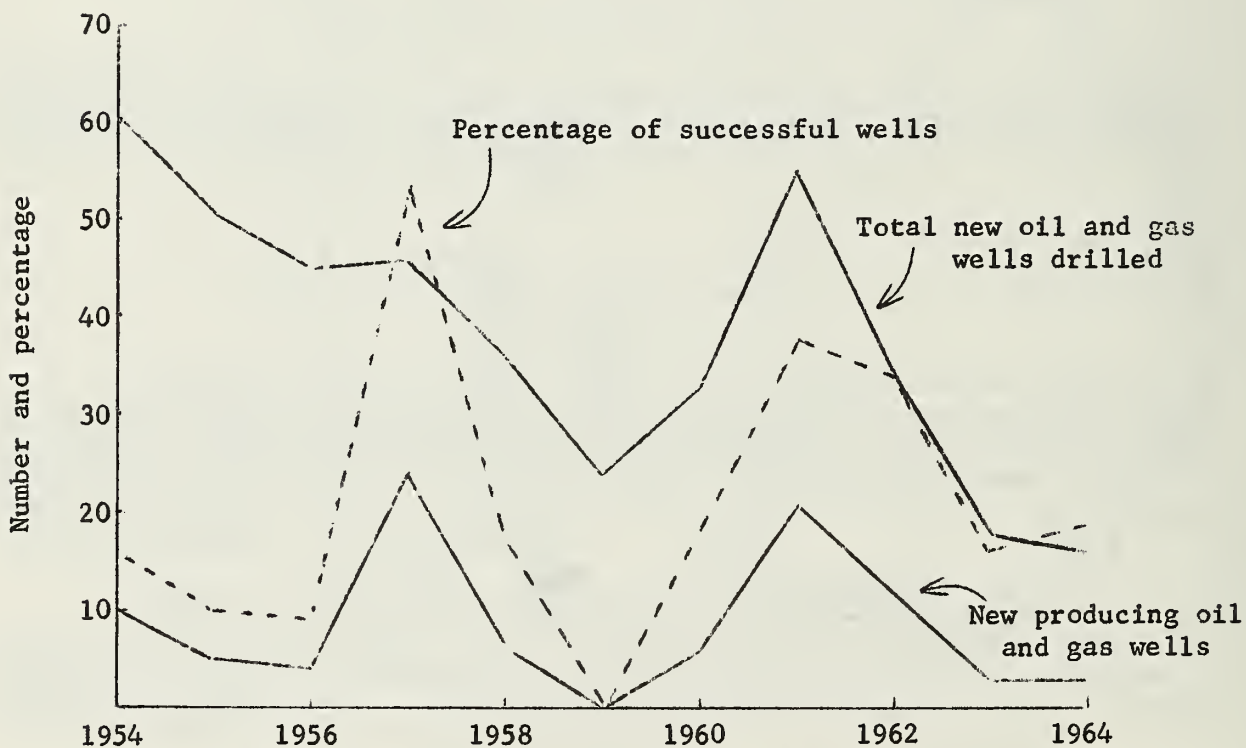


Fig. 17 - Drilling activity in the East St. Louis Region, 1954 to 1964.

TABLE 4 - CRUDE OIL PRODUCTION STATISTICS FOR THE EAST ST. LOUIS REGION

County	Cumulative production 1888-1964	Regional cumulative as % of state cumu- lative production	1964 production		1964 production as % of 1964 state total
			Bbls	Value*	
Madison	15,442	0.06	320,000	\$937,600	0.46
Monroe	2	Negligible			
St. Clair	2,883	0.01			
Total	<u>18,237</u>	<u>0.07</u>	<u>320,000</u>	<u>\$937,600</u>	<u>0.46</u>

\* Average price estimated at \$2.93 per barrel.

were 1957 and 1961 when the success ratios were 52 and 38 percent, respectively. Secondary recovery has been undertaken in only a modest way. In 1964 there were three active waterflood operations in the area.

#### SAND AND GRAVEL

Sand and gravel deposits are important natural resources that occur in many places in Illinois. These deposits are, with the exception of a few deposits located in extreme southern and western Illinois, related to past glacial activity. The Illinoian and Wisconsinan glacial periods produced the most important economic sand and gravel deposits in the state. An explanation of the origin of these deposits was prepared by Lamar and Willman (1958). Figure 18 shows the location of known sand and gravel resources in the East St. Louis Region.

It is not possible to give any meaningful data on reserves. As sand and gravel are low-value commodities, the market area in which they can compete is usually sharply restricted. Transportation costs often represent a greater portion of the delivered price than the initial value of the raw material at the pit site. Because of this, a deposit usually must be quite close to the market area to be economic. To be more specific, a study of nationwide transportation patterns has shown that rail hauls for aggregates average 80 to 90 miles; water hauls average 30 to 35 miles; truck hauls, accounting for about 80 percent of sand and gravel transportation, probably average well under 30 miles (Davidson, 1965, p. 1). However, these figures average out widely varying local conditions.

Regional production and value of sand produced between 1955 and 1964 are shown in figure 19. In 1964 three companies were producing sand in the East St. Louis Region and their cumulative production amounted to about 4 percent of the state total. Only extremely small quantities of gravel have

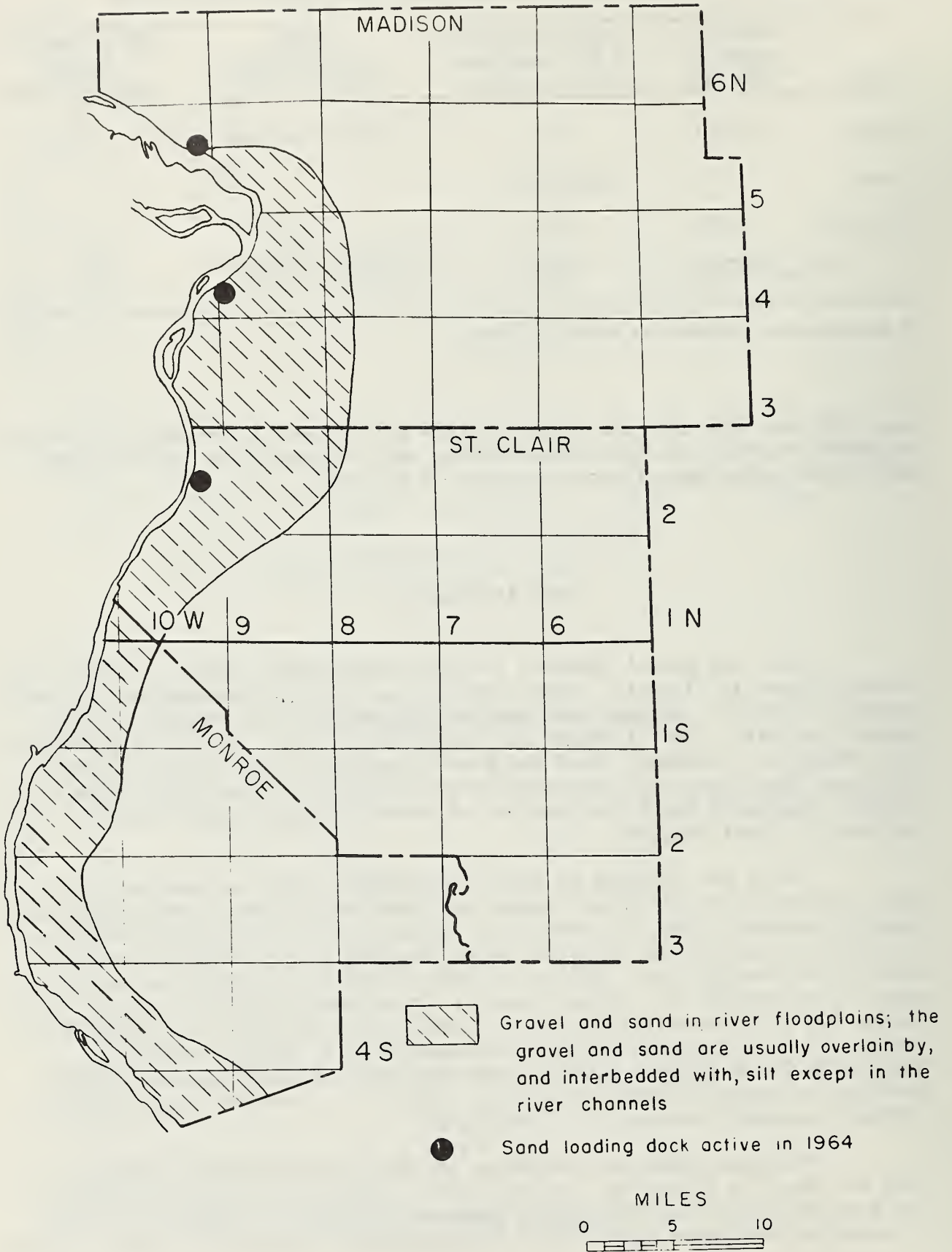


Fig. 18 - Sand resources and operations in the East St. Louis Region.



been produced in the area during the past decade. Some of the producers operate sand dredges in the Mississippi River, but have their loading docks on the Illinois side.

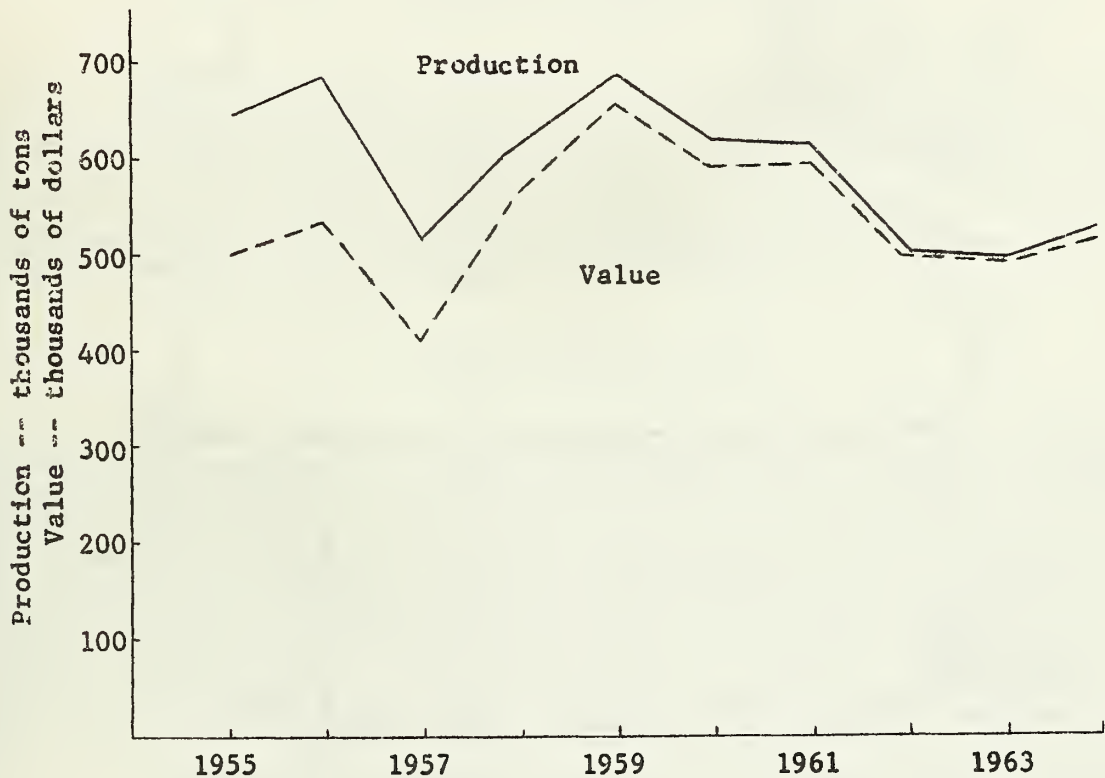


Fig. 19 - Sand production and value for the East St. Louis Region 1955 to 1964.

#### UNDEVELOPED MINERALS OF POTENTIAL IMPORTANCE

Illinois possesses a number of mineral deposits that, at present, are not being exploited. The low grade of the material and/or the high processing costs have made their exploitation uneconomic in the past. A brief discussion of these resources and the problems associated with their use is given below.

#### Oil Shale

Literature dated as early as 1870 reported the presence of oil in certain shales in Illinois, but no comprehensive testing and evaluation of these shales was carried out until 1956. At that time members of the staff of the Illinois State Geological Survey collected and tested 114 samples taken from 41 counties (Lamar, Armon, and Simon, 1956). Only three of the samples

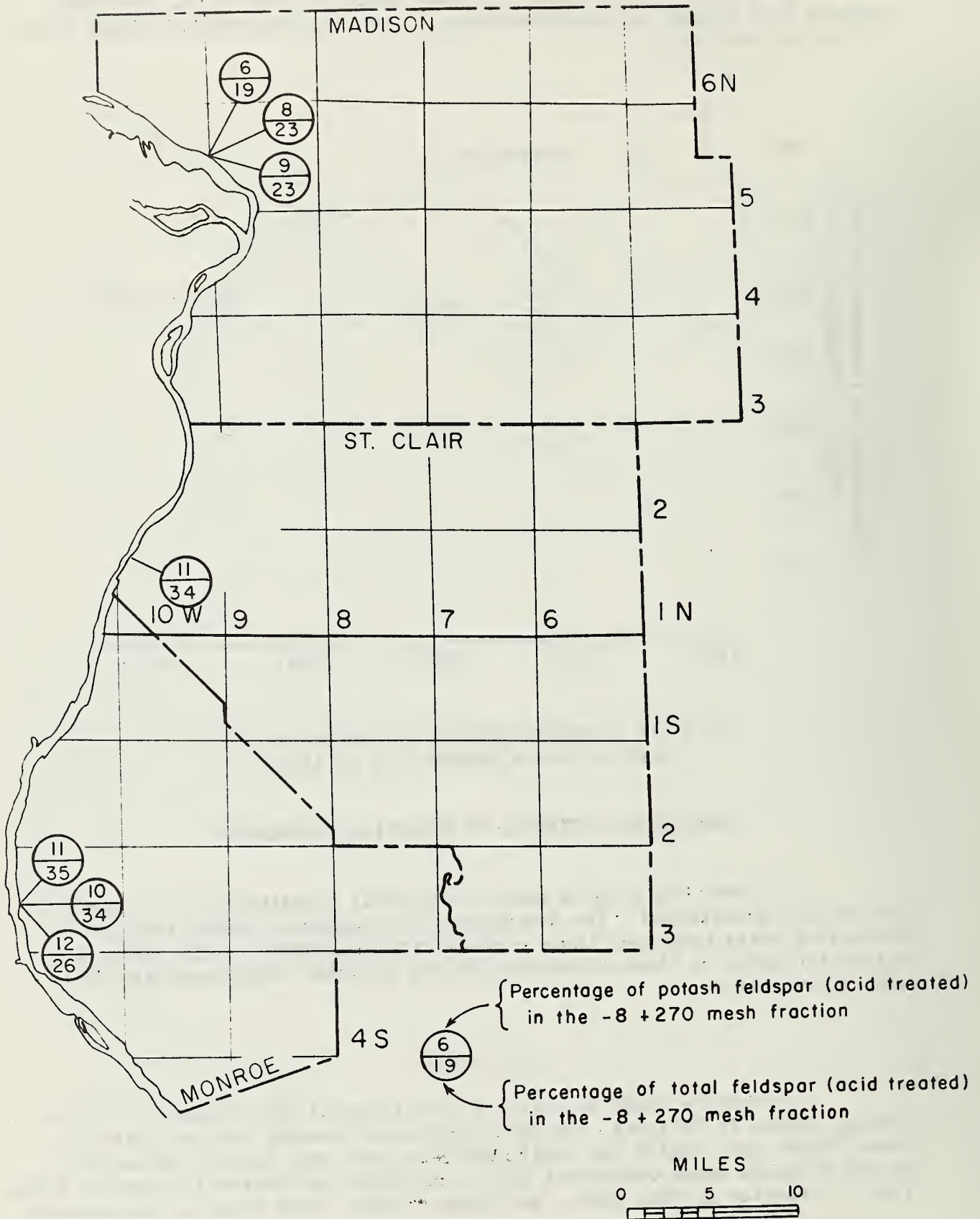


Fig. 20 - Feldspar-bearing sands in the East St. Louis Region.  
(Data from Willman, 1942.)

yielded more than 25 gallons per ton and the one sample from St. Clair County in the East St. Louis Region yielded just 11.0 gallons per ton of shale; this sample bed was less than 3 feet thick.

### Gypsum and Anhydrite

Gypsum and anhydrite beds are not known to crop out anywhere in Illinois, but both minerals have been encountered in wells drilled in the St. Louis Formation of southern and central Illinois. The gypsum and anhydrite are interbedded with limestone and with each other. In the vicinity of Edwardsville, deposits of this sort range up to 22 feet thick and occur at depths of about 600 to 800 feet. Additional information concerning these resources was reported by Saxby and Lamar (1957).

### Feldspar-Bearing Sands

Feldspar, an essential constituent in the manufacture of glass, pottery, and ceramics, is a mineral occurring in many Illinois sand deposits. In 1963 Illinois was the fourth largest consumer of feldspar in the United States, using 49,822 tons, all of which came from out-of-state because there was no feldspar produced in Illinois. At present, this imported feldspar comes from Colorado, South Dakota, and North Carolina and, therefore, substantial freight costs are involved. For this and other reasons, it has been suggested that certain of the sands in Illinois might be beneficiated to produce a feldspar concentrate of acceptable grade that could supply all or part of the state's needs.

A comprehensive study by Willman (1942) reported the actual percentage of potash feldspar and total feldspar found in Illinois sand samples. Locations of samples taken in the East St. Louis Region are shown in figure 20. The samples taken downstream from the juncture of the Mississippi and Missouri Rivers have the highest feldspar content of any samples in the state.

A key factor in the utilization of feldspar for ceramic purposes is the iron oxide content. Hunter (1965) studied the mode and amount of iron oxides in the feldspar in Illinois sands. He found that the sands contain potash feldspar, soda-lime feldspar, and feldspathic rock fragments, and that the potash feldspar contains less iron oxide than either the soda-lime feldspar or the feldspathic rock fragments. Laboratory acid treatment of the potash feldspar reduced its iron oxide content to near commercial grade. Seven samples of Mississippi River sands taken by Willman in the East St. Louis Region contained between 6 and 12 percent potash feldspar.

### Pyrite (Coal Brasses)

All coals contain sulfur in varying amounts; this sulfur occurs in three forms — as pyrite, in organic combination, and as sulfates. Much of the pyrite, known as coal "brasses," are removed during the cleaning process. However, due to a lack of market, they are discarded. In 1952 when sulfur was scarce on the world market, Voskuil (1952) prepared a study on the market outlook for sulfur recoverable from coal. However, during the late 1950's

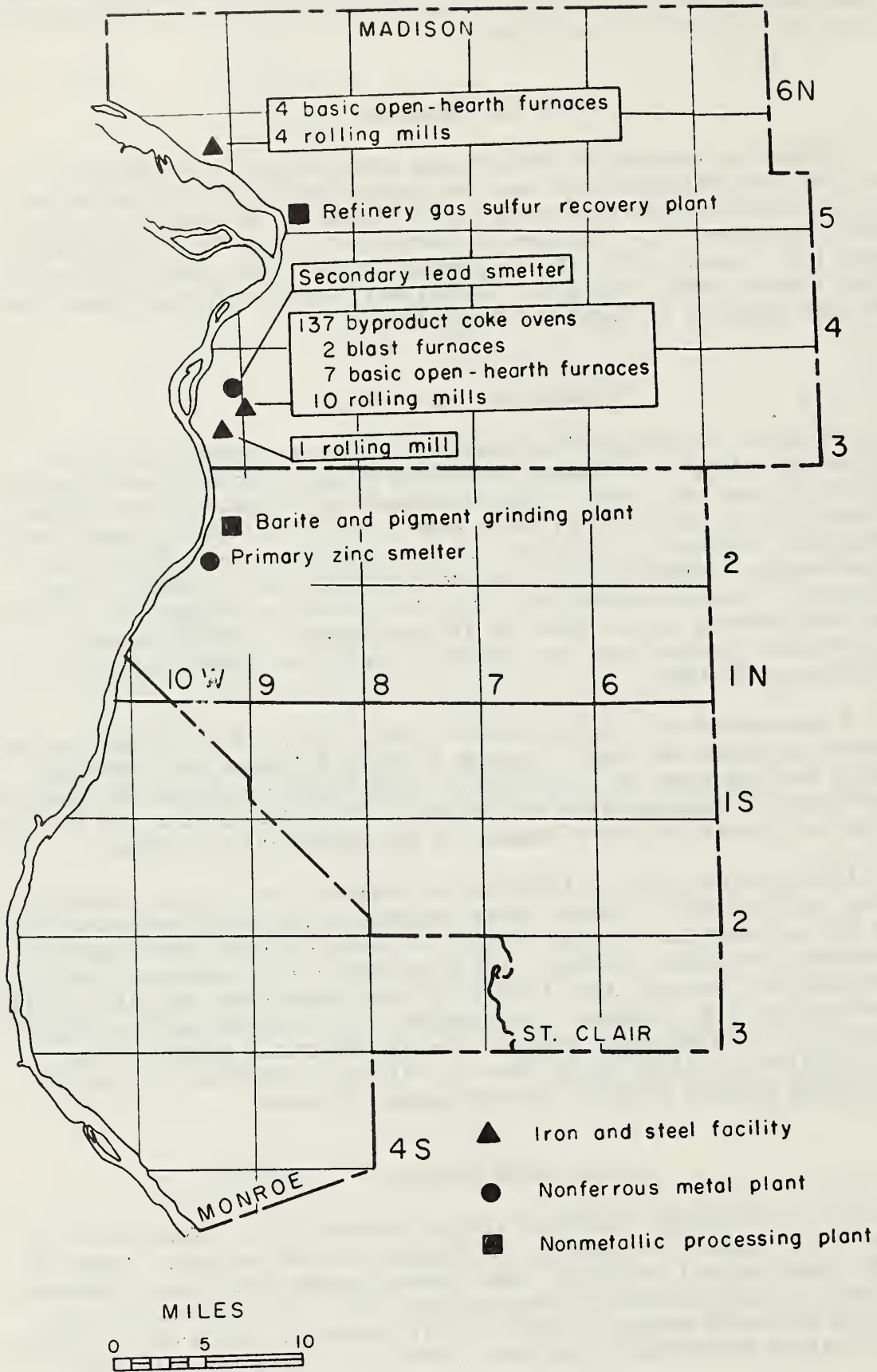


Fig. 21 - Mineral and metal processing facilities in the East St. Louis Region.



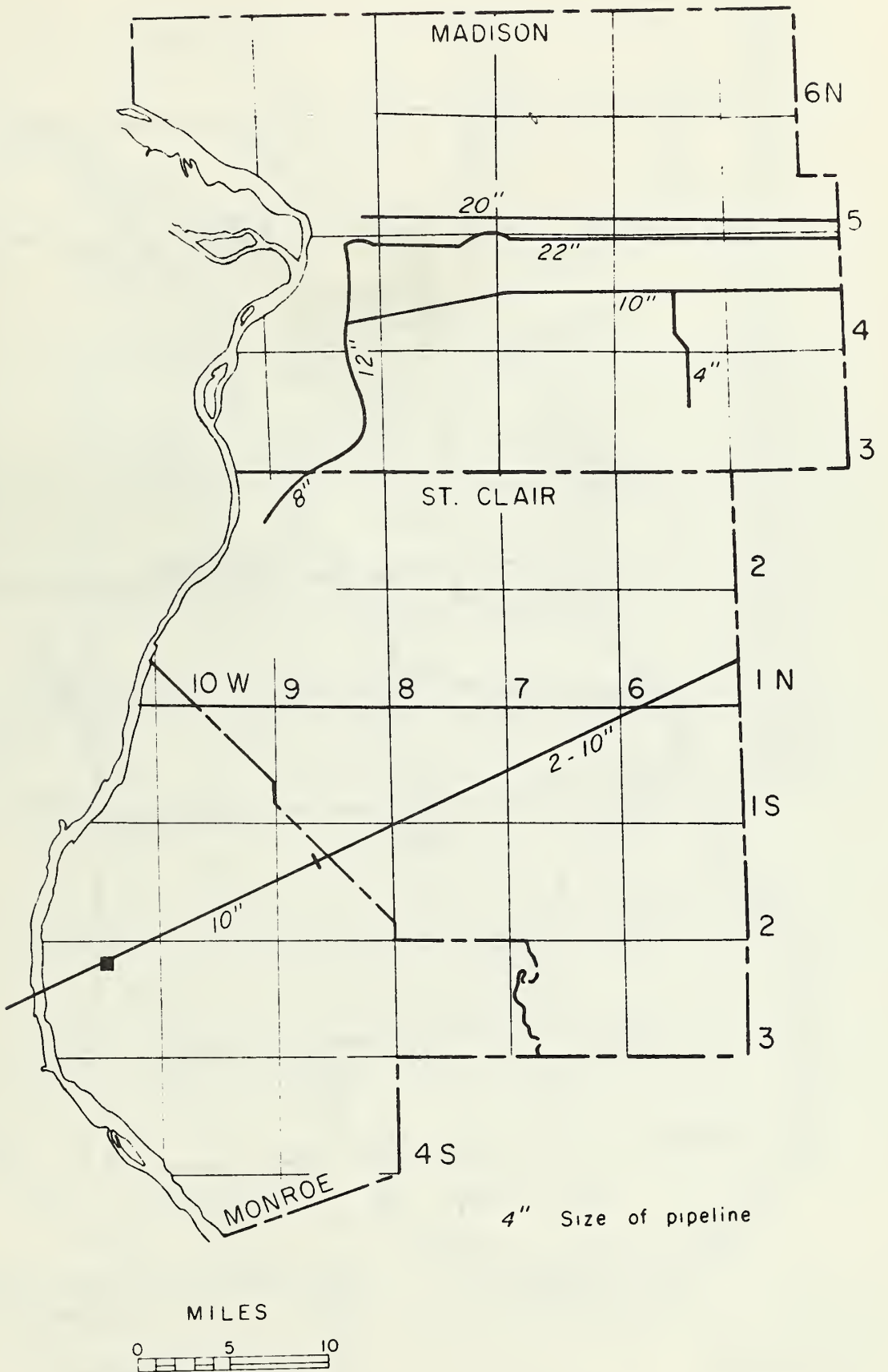


Fig. 22 - Crude oil pipelines in the East St. Louis Region.

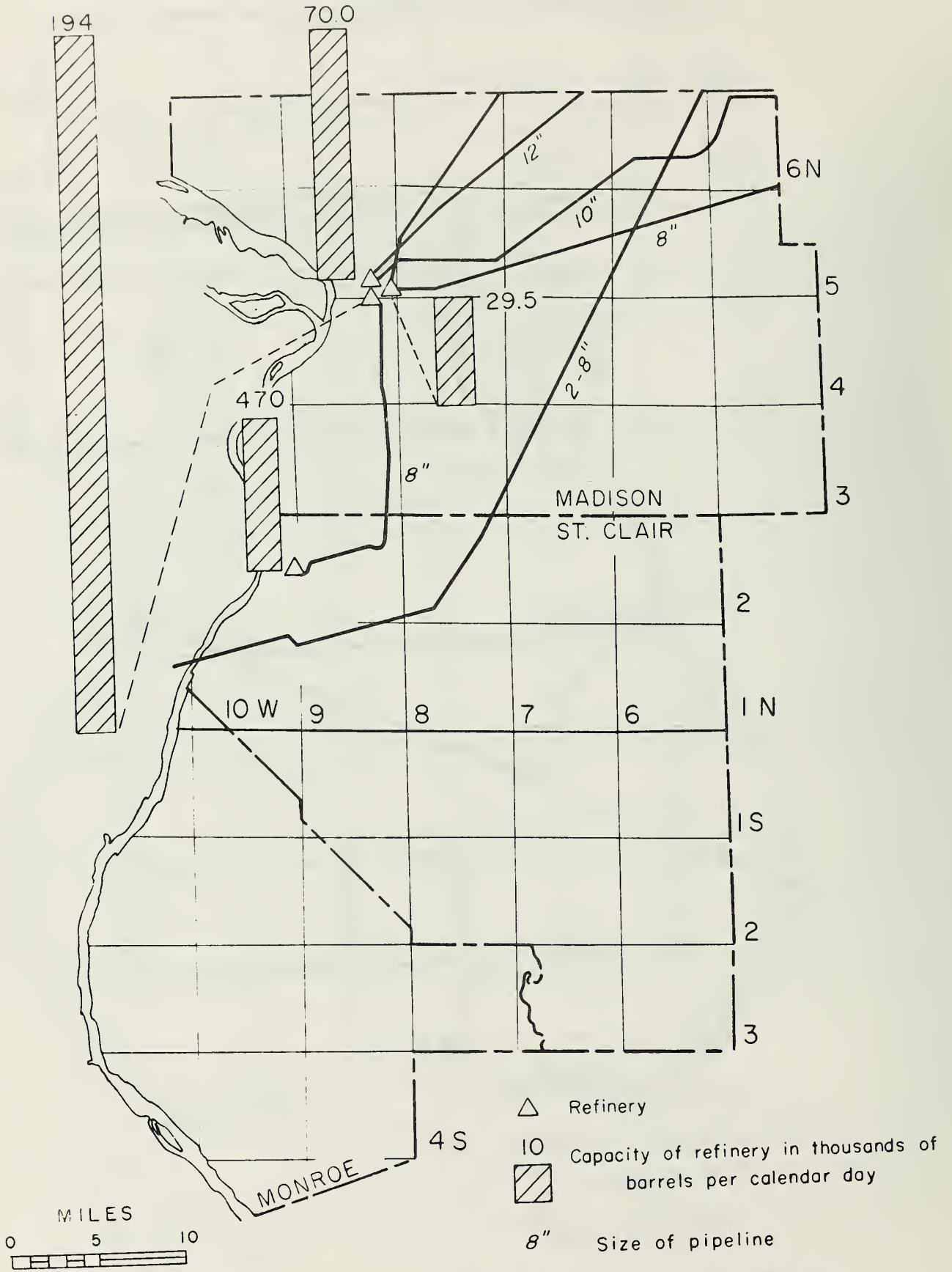


Fig. 23 - Refineries and refined petroleum products pipelines in the East St. Louis Region.

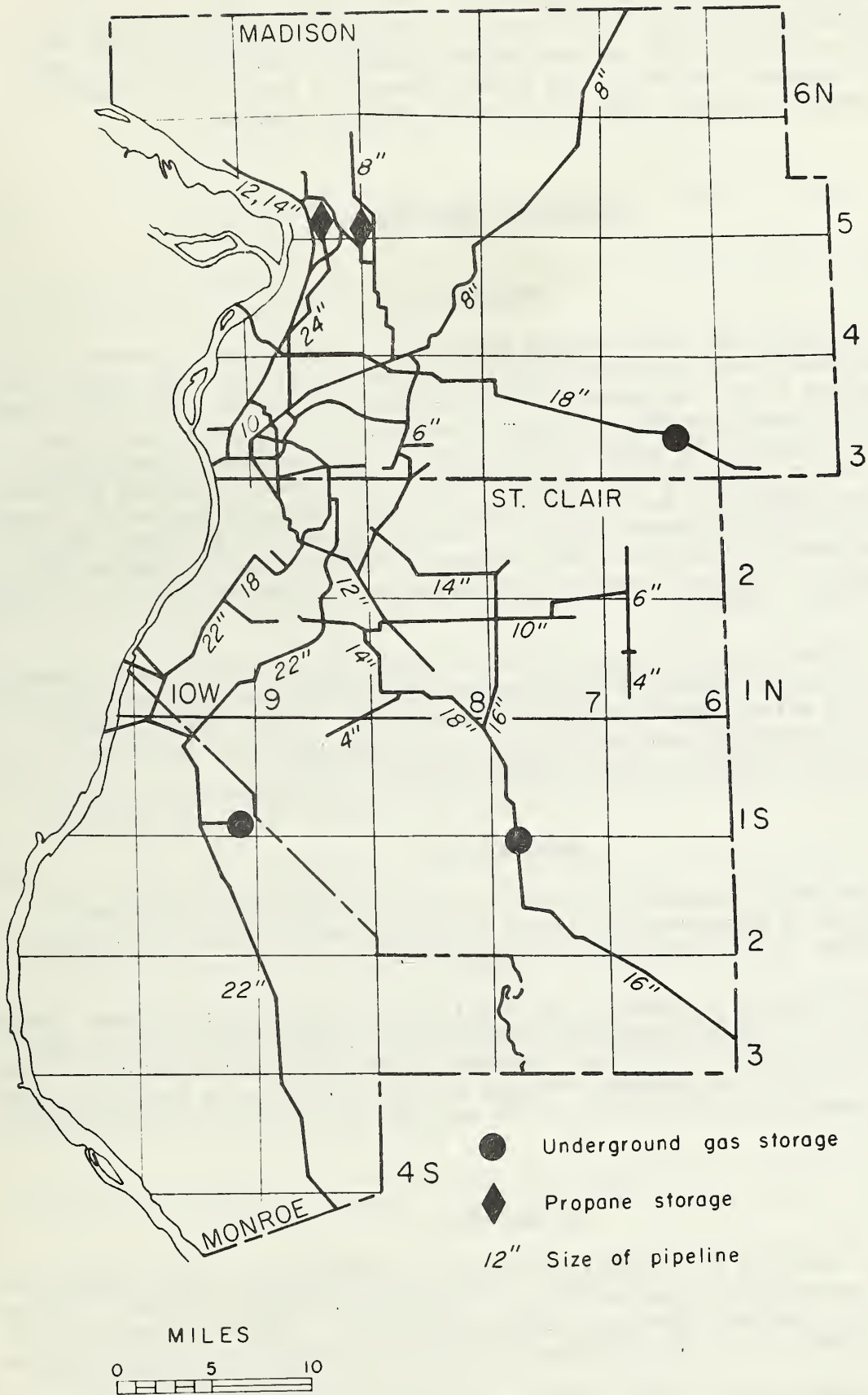


Fig. 24 - Natural gas pipelines and storage facilities in the East St. Louis Region.

and early 1960's sulfur production tended to exceed demand. In 1961 and 1962, production outstripped demand by a million tons, and prices were depressed to \$20 per ton. However, by 1965 a shortage had developed and the prices were up to \$31 per ton (Mining Journal, 1966, p. 23). If the shortage continues and prices are forced upward, it may become economic to exploit such alternative sources of sulfur as coal brasses.

## PROCESSING FACILITIES

### Metals

The East St. Louis Region possesses, in addition to primary mineral production facilities, various processing plants (fig. 21). The largest of the operations is the integrated steel plant of the Granite City Steel Company. The company obtains its iron ore from Iron Mountain, Missouri, and other sources. It operates by-product coke ovens, blast furnaces, open-hearth furnaces, and rolling mills at Granite City. The blends of coking coal that Granite City Steel uses in its coke ovens include about 75 percent Illinois coal, and in 1965 the company was the largest consumer of Illinois coking coals. In addition, Laclede Steel Company at Alton produces steel in open-hearth furnaces that is formed in rolling mills at Alton and Madison (Am. Iron and Steel Inst., 1964).

Nonferrous metals facilities are to be found in Granite City and Monsanto, Illinois. American Zinc Company of Illinois operates an electrolytic type of primary zinc smelter in Monsanto (U. S. Bur. Mines, 1963, p. 1319). A secondary lead smelter is operated in Granite City by the National Lead Company (U. S. Bur. Mines, 1964a, p. 709).

### Nonmetallics

The Anlin Company of Illinois recovers by-product sulfur from refinery gases at Wood River using the Anlin Gas Purification and Modified Claus processes (U. S. Bur. Mines, 1964b, p. 382).

The Minerals, Pigments and Metals Division of Charles Pfizer Company, Inc., in East St. Louis operates a custom grinding plant. This plant was formerly known as C. K. Williams & Company. Using mineral raw materials from out-of-state mines, the company produces ground barite, and a wide variety of finished pigments derived from iron ore and pyrite cinders (U. S. Bur. Mines, 1964b, p. 386).

### Oil and Gas

In addition to production facilities, the East St. Louis Region has extensive transportation, processing, and storage facilities for oil. Figure 22 indicates the crude oil pipelines within the region. Refinery locations and capacities (1965) and refined petroleum products pipelines are shown in figure 23.

Although the actual production of natural gas is negligible, there are extensive gas pipelines and storage facilities in the area (fig. 24).



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